Empirical Article

Including Deaf and Hard-of-Hearing Students With Co-occurring Disabilities in the Accommodations Discussion

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Students who are deaf or hard of hearing (SDHH) are a low-incidence group of students; however, SDHH also have a high incidence of additional disabilities (SDHH+). Many SDHH and SDHH+ require accommodations for equal access to classroom instruction and assessment, particularly in mainstreamed educational settings where spoken English is the primary language. Accommodations for SDHH, overall, have increased under federal legislation including the Individuals with Disabilities Education Improvement Act and the No Child Left Behind Act. Unfortunately, specific practice recommendations for SDHH+ and their unique needs are often lacking in the research literature. This article presents findings regarding accommodations use by SDHH and SDHH+ from the National Longitudinal Transition Study 2. Initial logistic regression analysis found no differences in accommodations use of SDHH and SDHH+. However, logistic regression analysis that compared specific additional disability groups with the larger overall SDHH group did find differences in accommodations use for two SDHH+ groups: students who had a learning disability and students with attention deficit hyperactivity disorder. This article includes a discussion of the implications of these findings for both research and practice.

For decades, educational policy and practice in the United States have sought to minimize barriers to educational access for students with disabilities (Individuals with Disabilities Education Act, 1997; No Child Left Behind Act of 2001, 2002; Individuals with Disabilities Education Improvement Act of 2004, 2003). Accommodations and modifications are now part of the everyday instruction and testing of thousands of students with disabilities across the United States (Bolt & Thurlow, 2004). The purpose of these accommodations is to improve access to the material presented in instruction and to ensure accurate assessment of student knowledge of the test material (Christensen, Braam, Scullin, & Thurlow, 2011). There are a wide variety of accommodations used for this purpose, which are selected by a student's Individual Education Program (IEP) team with the students' unique educational needs in mind (Individuals with Disabilities Education Improvement Act of 2004, 2003). Classroom or instructional accommodations seek to provide opportunities for students to derive educational benefits from the learning environment. For example, a student may need additional time to complete an assignment or require reading materials to be provided in a large print format. Testing accommodations are meant to remove barriers that are part of the testing environment or characteristics of the test itself but are not an essential part of the knowledge or construct on the assessment. For example, a possible test accommodation would be additional time on a math test. In this example, the student is not penalized for how quickly they are able to complete the test, but instead their ability to complete math problems is more accurately measured (Bolt & Thurlow, 2007). In this way, testing accommodations "level the playing field" for students with disabilities and seek to provide an accurate and fair measure of student knowledge.

Students who are deaf or hard of hearing (SDHH) are likely to use accommodations in both

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classroom instruction and assessment, depending on their individual characteristics and the educational setting (Cawthon & Online Research Lab, 2008; Cawthon, 2011a; Garberoglio, Cawthon, & Bond, in press). Many SDHH use accommodations that are commonly used by other eligible students, such as extended time, and also use accommodations that fit the unique communication and learning needs of this population (Cawthon & the Online Research Lab, 2006). For example, accommodations uniquely relevant to SDHH might include American Sign Language (ASL) interpretation of test items or of test directions, note taking during lectures, speech-to-text services during lectures or classroom activities, and use of assistive listening systems and captioning of videos used in class (Cawthon, 2011b). It is important to note that accommodations are not mutually exclusive; students may use only one accommodation, or they may use many, depending on their unique educational context and preferences.

One factor that may influence how many accommodations and in what combination SDHH use them is the presence of additional disabilities. Because a large percentage of individuals who are deaf or hard of hearing (D/HH) do have an additional disability, with some estimates ranging from 35 to 50% of the D/HH population, students with multiple disabilities, or SDHH+, may be as representative of the population as those without (Holden-Pitt & Diaz, 1988; Mitchell & Karchmer, 2006). Additional disabilities that SDHH+ have widely vary from struggling with mental health concerns such as anxiety or depression to educationally related disabilities such as learning disabilities or intellectual disabilities (Shaver, Newman, Huang, Yu, Knokey, 2011). Students with additional disabilities may also have other physical or motor disabilities such as blindness or cerebral palsy. Finally, the rise in the diagnosis of autism spectrum disorders is mirrored in the rise of SDHH who also have autism (Szymanski, Brice, Lam, & Hotto, 2012).

Given the diversity in additional disabilities, it is easy to imagine the diversity of accommodations that are used to meet the accessibility needs of SDHH+. It is also important to note the heterogeneity of these students with respect to their accommodations use— accommodations that are meant to be tailored to the individual student and their educational need (Individuals with Disabilities Education Improvement Act of 2004, 2003). Therefore, it is possible that students with the same constellations of disabilities may use very different accommodations. For example, a third grade student who has cerebral palsy and is D/HH may require different accommodations than another third grade SDHH without cerebral palsy, depending, in part, on their educational needs and the severity of their disability; one may require a motorized wheelchair and a symbol key pad whereas the other may be able to use other assistive technology and communicate via ASL.

The purpose of this article is to present findings from the National Longitudinal Transition Study 2 (NLTS2), a large national multiwave study of students with disabilities, including SDHH and SDHH+. As part of this project, we systematically reviewed the literature to summarize current findings on accommodations use for SDHH and SDHH+. We then conducted an analysis of accommodations data available in the NLTS2 to investigate whether SDHH and SDHH+ used similar or different types of instructional and assessment accommodations.

Accommodations and SDHH+ in the Literature

Project staff searched key databases in pursuit of articles concerning SDHH, SDHH+, and accommodations. The research databases searched included PsycInfo, ERIC, Dissertation Abstracts International, and Educational Abstracts. Search terms included "accommodations*," "deaf*," "hard-of-hearing*," and "deaf and hard-of-hearing*" (both with and without the hyphens). The research literature search yielded 31 articles, 19 of which were quantitative or qualitative studies of SDHH and accommodations. The remainder were articles that detailed the current use of particular accommodations or best practices regarding these students. Additionally, several of the studies in this literature review examined modifications rather than accommodations. Modifications are changes to the assessment process that are likely to change the difficulty or scope of the construct and result in test scores that are not comparable to those from an unmodified test. Due to the small number of studies that examined accommodations for SDHH, the decision was made to

include these studies in this literature review and to note them accordingly.

A summary of the studies on SDHH and accommodations use, as well as their inclusion of SDHH+ in the analysis or discussion, is provided in Table 1. The types of accommodations investigated in the research literature reflect, in part, the legal requirements regarding accommodations in K-12 settings versus postsecondary settings. In K-12 classrooms, students' accommodations are monitored and addressed through their IEP Plan, which is required as part of the Individuals with Disabilities Improvement Act of 2004 (2003). Additionally, the No Child Left Behind Act of 2001 (2002) addresses the inclusion of these students in mandated accountability testing. In contrast, the accommodations utilized in postsecondary settings are in the purview of the Americans with Disabilities Act of 1990 (1991). Under this act, the student, rather than the institution, is responsible for requesting accommodations and notifying the appropriate office of their disability. However, a wider variety of accommodations may be available in a higher education setting than in a students' school district (Cawthon, 2011b). Additionally, students at the postsecondary level may be more likely to use speech-to-text technologies, which require a particular level of print proficiency, than students in K-12 settings (Stinson, Elliott, Kelly, & Liu, 2009).

For instructional accommodations, the emphasis was on a range of options to make classroom lecture content more accessible for SDHH. Marschark et al. (2005) indicated that there were no significant differences between ASL live interpretation and ASL videotaped interpretation of academic content on college student performance. In a study of interpreter/note taker combination accommodation versus speech-to-text services, Stinson et al. (2009) found that high school students were more likely to retain material presented in speech-to-text services. However, this finding was not borne out in the college participants, who performed equally well under both conditions. Anderson-Inman, Terrazas-Arrellanes, and Slabin (2009) found that students' access to extended captions did not influence their retention of material in educational videos. Marschark et al. (2009) indicated that SDHH struggled with retention of material presented both in ASL and in written English.

Several articles also addressed assessment accommodations. In this context, assessment accommodations may refer to accommodations utilized during large-scale standardized testing, standardized assessments (e.g., Stanford Achievement Test, Gardner, Rudman, Karlsen, & Merwin, 1982 and the Wechsler Intelligence Scales for Children, Wechsler, 2003), or assessments conducted by individual instructors to determine student skills or assessments. The type of assessment (e.g., large-scale accountability testing, standardized assessment, and instructor assessments) is included in Table 1. For assessment accommodations, most of the studies examined the sign language interpretation of test items accommodation. A common thread in several studies is the potential confound of a lack of a time limit. Although it does take longer to administer a test in sign language, an unlimited time allotment for an assessment with a time limit constitutes an extended time accommodation as well as a sign language interpretation accommodation. Three of the studies indicated no difference in student scores due to administration type: ASL versus paper-pencil (Cawthon, Winton, Garberoglio, & Gobble, 2011) or ASL interpreter versus avatar (Russell, Kavanaugh, Masters, Higgins, & Hoffman, 2009); ASL interpreter versus ASL proficient examiner (Sullivan & Schulte, 1992). Maihoff et al. (2000) indicated that they were unable to give conclusive results because they did not use comparable test forms for the accommodated and nonaccommodated conditions. Johnson, Kimball, and Brown (2001) concluded that the ASL interpretation of items without a certified interpreter who possesses experience in educational settings can result in vital test item content, particularly visual content (e.g., graphs), being misrepresented or lost. Mowl (1985) found no significant differences in test performance between SDHH who took the modified version of a reading test and those who took the standard version. In the same study, investigations into item modifications resulted in some increases in student math performance although these modifications may influence construct validity (Elliott, et al., 2010) and thus the interpretation of a student's scores.

In all, these results make it difficult to make a definitive statement regarding benefits or drawbacks of presenting test items in sign language format versus English

Table 1 Summary of research studies

Study (in order of appearance)	Accommodations investigated	Setting of participants	Accommodation type (assessment type)	D/HH+ included in study?	D/HH+ findings described/data disaggregated?
Allen and Osborn (1984)	n/a	K–12	n/a (standardized)	Yes	Yes
Mowl (1985)	Item modifications (control syntax and vocabulary)	K–12	Assessment (standardized)	Unknown	n/a
Sullivan and Schulte (1992)	ASL presentation of items	K–12	Assessment (standardized)	Unknown	n/a
Maihoff et al. (2000)	ASL presentation of items	K–12	Assessment (standardized)	Unknown	n/a
Johnson, Kimball, and Brown (2001)	SEE-II presentation of items	K–12	Assessment (accountability)	Unknown	n/a
Marschark et al. (2005)	Video/live interpreting of lecture material	College	Instructional (instructor)	Unknown	n/a
Marschark et al. (2006)	ASL interpretation of lecture material	College	Instructional (instructor)	Unknown	n/a
Cawthon and Online Research Lab (2006)	Extended time, interpreter for directions, separate room for test administration, frequent breaks, signed questions response, read aloud	K–12[b]	Assessment (accountability)	Yes	No
Ansell and Pagliaro (2006)	ASL presentation of items	K–12	Instructional (instructor)	Unknown	n/a
Wolf (2007)	Extended time, teacher clarification, re-read directions, follow flexible schedule, simplify language in directions, sign or read written directions	K–12	Assessment (standardized)	No[a]	n/a
Anderson-Inman et al. (2009)	Expanded captions	K–12	Instructional (instructor)	Unknown[b]	n/a
Marschark et al. (2009)	ASL presentation of test items; ASL response format	College	Instructional (instructor)	Unknown	n/a
Russell et al. (2009)	ASL presentation of items	K–12	Assessment (accountability items)	Unknown	n/a
Steinberg et al. (2009)	Not specified	K–12	Assessment (accountability items)	Unknown[a]	n/a
Scarpeti et al. (2009)	Presentation Accommodations	K–12	Assessment (accountability)	Possible	Not fully described
Stinson et al. (2009)	Lecture w/speech to text; Interpreting/note taking services	K–12; college	Instructional (instructor)	Unknown[c]	n/a
Hoffman and Wang (2010)	Leveled text using ASL graphics	K–12	Instructional (instructor)	Unknown	n/a
Cawthon and Wurtz (2010)	Extended time, test directions interpreted, test items interpreted, test items read aloud	n/a	Assessment (accountability)	Yes	Yes, SDHH+ blind, SDHH+ learning disability
Cawthon et al. (2011)	ASL presentation of items	K–12	Assessment (standardized)	No	n/a

Note. ASL, American Sign Language; D/HH, deaf or hard of hearing; SDHH, students who are deaf or hard of hearing; SEE-II, Signed Exact English.

[a]The study included a measure of student reading level; although this cannot be sure to distinguish students as not having a secondary disability, this provides more information about the students' characteristics.

[b]Age range of students served by study participants.

[c]The study excluded children who were not reading on grade level.

print format for students who are at the high school and college level. Although an accommodation may not necessarily be associated with or predict higher scores, students appear to appreciate and prefer the availability of the accommodation (Anderson-Inman et al., 2009; Russell et al., 2009). Additionally, certain accommodations may be utilized more in particular settings than others. Cawthon and the Online Research Lab (2006) indicated that mainstream school programs were more likely to use accommodations in statewide accountability assessments than schools for the deaf (although this may reflect the school's communication medium more than the school's accommodation resources). These findings underscore the need for further studies examining the link between assessment and instructional accommodations with student performance.

Accommodations and Student Characteristics

In addition to examining accommodations, several of the articles explored other factors that might influence the efficacy, delivery, or use of an accommodation, such as the interaction between the interpreter and the student (Johnson et al., 2001; Marschark et al., 2005; Marschark et al., 2006), student proficiency with written English (Steinberg, Cline, Ling, Cook, & Tognatta, 2009), and student communication modality (Stinson et al., 2009; Cawthon et al., 2011). Findings on student communication modality or preference indicated no significant effect on students' performance (Marschark et al., 2006; Stinson et al., 2009). Additionally, student reading proficiency did affect student's performance and educator's perspective on appropriate accommodations for standardized assessments. Cawthon et al. (2011) found that student exposure to ASL instruction did predict student math scores. In sum, there are individual-level factors (such as student reading proficiency) and test-level factors (such as interpreter quality) to consider when examining accommodations use and efficacy for SDHH.

Students With Co-occurring Disabilities

An additional layer of complexity to consider in the accommodations discussion is the consideration of whether a student has an additional disability. Despite the growing number of SDHH with additional disabilities (Shaver et al., 2011), and several articles that highlight the importance of examining accommodations for this group of students (Cawthon & Online Research Lab, 2006), very few of the articles found in the experimental research literature specifically examined accommodations for SDHH+. Many of the articles in this review did not give any information as to additional disabilities of their participants perhaps because this information was either incomplete or unavailable from student records. However, several articles did specifically exclude these students (Cawthon et al., 2011), and a few did restrict the students in their sample according to their reading level to reduce confounds in studying the effects of accommodations on student outcomes (Wolf, 2007; Anderson-Inman et al., 2009; Steinberg, et al., 2009; Stinson et al., 2009). Articles that looked at accommodations use as reported by professionals working with SDHH (Cawthon & the Online Research Lab, 2006; Cawthon & Wurtz, 2010) often included SDHH+ in their sample but did not report specifically on data regarding SDHH+. However, this may reflect the limitations of collecting data from professionals who work with a variety of SDHH, including those with and without additional disabilities. However, none of the studies specifically disaggregated these students from their data and examined these students within their own analysis.

The purpose of this article is to take initial steps to address the gap in the literature on accommodations and SDHH. This study's investigation is guided by three research questions:

1. Are SDHH+ more likely to use particular accommodations than SDHH without additional disabilities?
2. Are SDHH+LD more likely to use particular accommodations in comparison with other SDHH+?
3. Are SDHH+ ADD/ADHD (SDHH+ADHD) more likely to use particular accommodations in comparison with other SDHH+?

Methods

Data Collection

This analysis used data from the NLTS2. The U.S. Office of Special Education Programs and the Institute of Education Sciences (IES) commissioned the NLTS2

to better understand the accomplishments of students transitioning into adulthood. The NLTS2 study stratified operating American public schools based on their region, enrollment size, and district wealth prior to random sampling. The "region" stratification consisted of the categories Northeast, Southeast, Midwest, and West and was previously used by the National Assessment of Educational Progress, the U.S. Department of Commerce, and the U.S. Bureau of Economic Analysis. The enrollment size stratification depended on the number of students enrolled in grades 7 through 12, inclusive. Rather than employing simple random sampling, the NLTS2 study divided operating American public schools into groups based on their region, enrollment size, and district wealth prior to random sampling. Stratifying the population in this way allowed for more efficient estimation. It also allowed for the generation of sampling weights, which ensured that NLTS2 was nationally representative. Schools were coded as having a large enrollment if they had between 4,660 and 14,930 students enrolled. On the other hand, they were coded as having medium enrollment if they had between 1,620 and 4,660 students enrolled. Finally, schools with enrollments outside of this range were classified as either "small" or "very large." The final stratification, district wealth, was computed as a function of the percentage of the student population living below the federally defined poverty line (also known as the "Orshanky index"; see Fisher, 1992). If 25–43% of the students lived below the poverty line, district wealth was classified as "low." If this percentage was between 14 and 24, district wealth was coded as "medium." Percentages outside of this range were classified as either "high" or "very low." After the schools were stratified, students within these schools were further stratified by disability category and randomly selected. NLTS2 used these stratifications to compute sampling weights for students, which adjusted for nonresponse bias while also improving sample efficiency.

The NLTS2 study collected data in five separate waves, beginning in 2001 and following up in 2003, 2005, 2007, and 2009. The students were between 13 and 16 years old on December 1, 2000. Data were collected through computer-assisted telephone interviews, mail surveys, and direct assessments of the students. The direct assessments were only administered in the first two waves. Students, parents/guardians, and school staff all provided information about a wide variety of topics. Although the data set has responses from many different stakeholders in five separate waves, this analysis only uses information from parents and school staff in the first wave.

Instruments and Coding

Parents and school staff provided two distinct pieces of information that were needed for this study. Firstly, parents confirmed the presence of the additional disabilities that the school district reported. A student with a disability was only selected for this study if parents indicated that the child had a diagnosis of "deafness" or "hearing impairment." Parents confirmed this either by filling out a questionnaire by mail or by responding to a computer-assisted telephone interview. NLTS2 collapsed a number of disabilities for the sake of parsimony. Most relevantly, the categories of "deafness" and "hearing impairment" were combined into a single category for this particular variable (np1B1a_11). This variable was chosen because the main construct of interest was SDHH with an additional disability, rather than potential interactions of additional disabilities with variations in hearing loss (i.e., mild, moderate, and profound). Additionally, attention deficit disorder (ADD) and attention deficit hyperactivity disorder (ADHD) were combined into a single category, and learning disabilities and dyslexia were also collapsed into one group.

School staff provided another relevant piece of information, namely, the accommodations provided to students during standardized tests, assessments, or during instruction throughout the school year. They did this by filling out a questionnaire by mail. The staff provided a great deal of information about accommodations, and many variables were combined. For the sake of parsimony, we selected several accommodation categories and combined them to result in seven different accommodation categories. Frequency counts of these accommodation categories are provided in Table 2.

Three of the seven accommodation categories involved instructional accommodations, meaning they were provided in the student's classroom. First, the additional access to technology category encompassed adaptations to computer software or hardware to meet students' unique

needs, or if they were allowed to use a computer when other students were not, or if they were provided general communication aids (e.g., Touch Talker and manual printing board). Second, the tutor category encompassed peer tutors, adult tutors, and extra assistance with study skills. Finally, if a teacher aide, instructional assistant, or other personal aide was provided to the student, the student was coded as having one-on-one support.

The last four of the seven accommodation categories could have been provided either in regular classroom settings or during standardized tests. Students were considered to have access to sign language if sign language was used to teach a class, or if an interpreter was provided for standardized tests. Similarly, readers for in-class and standardized tests were collapsed into a general "readers provided for tests" category. Also, the general category of "different forms for tests" encompassed modified in-class tests, different grading standards, and alternate forms of in-class or standardized tests. Fourthly, students were categorized as having additional time if they had extra time on standardized tests, in-class tests, or in-class assignments.

Although NLTS2 has separate missing codes for "skipped," "not applicable," "refused," and "withdrawn," among others, all the missing codes are treated in the same way for this study. Because the data being used are from the first wave of NLTS2, it was thought that list-wise deletion would be appropriate in all cases.

Participants

Because NLTS2 provides individually identifiable data, the descriptive frequencies reported here are rounded to the nearest tens place. This is in accordance with IES policy. The data set consists of 630 D/HH students whose parents provided information about their additional disabilities, and whose school staff gave information about the accommodations available in their institution (Table 3). Although the weighted data differ somewhat from these estimates, for the sake of simplicity, only the raw frequencies are reported here.

Table 2 Frequency counts of accommodations

Accommodation	Frequency of use
Technology use	130
Use of tutors	220
One-on-one support	130
Interpreter access	280
Readers for tests	200
Different forms of tests	270
Additional time	410

Note. In accordance with Institute of Education Sciences policy, the frequencies reported here are rounded to the nearest tens place.

Analysis Procedure

For the first analysis we chose to predict disability categories from accommodations use in logistic regression due to the high number of disability categories in the NLTS2 data set and because accommodations use for each accommodation was dichotomous. This means that for the accommodation variables students either used the particular accommodation (e.g., access to sign language) or they did not. Similarly, for the dependent variable, disability status, students either had an additional disability, such as an LD, or they did not. In this analysis, three disability statuses and seven accommodation categories were of interest. Logistic regression analyses provide information regarding model fit and significance of effects (Mertler & Vannatta, 2005). The Wald statistic is used to determine the significance of each predictor in the model, which, in this case, is the students' use of each of the seven chosen accommodation categories. Ultimately, the goal of the first analysis was to determine if student accommodations use could reliably distinguish between SDHH with additional

Table 3 Demographic information

	Observed *n*
Had additional disability	310
ADD/ADHD[a]	110
Learning disability	90
Visual disability	60
Autism	10
Ethnicity	
Caucasian	430
African-American	130
Asian	30
American Indian/ Alaskan Native	20
Age	
13–14	200
15	140
16	170
17	120

Note. [a]ADD/ADHD, attention deficit disorder/attention deficit hyperactivity disorder.

disabilities and those without disabilities. This analysis creates odds ratios that are a measure of the effect size. An odds ratio of 1 indicates that there is no effect, and an odds ratio of greater than 1 indicates a positive association between the predictor and dependent variables. Similarly, the goal of the second and third analysis was to determine if student accommodations use could reliably distinguish between SDHH with an LD and SDHH without an LD and between SDHH with ADHD and SDHH without ADHD, respectively.

Results

In total, three separate logistic regression analyses were conducted. The first analysis attempted to predict whether a D/HH student had any additional disability (Research Question 1). The second and third analyses predicted whether a DHH student had ADD/ADHD or an LD, respectively (Research Questions 2 and 3).

Before the logistic regressions are discussed, basic descriptive information about the independent variables is given.

The predictors for all three of the analyses were the same, namely, the seven accommodation categories that were previously discussed. Again, the categories were use of technology, use of tutors, use of one-on-one support, use of readers for tests, different forms for tests, extra time for tests, and access to sign language. Note that all of these predictors are binary in nature, where 0 represented "accommodation unused" and 1 represented "accommodation used."

The NLTS2 data set is both clustered and stratified. As such, to properly compute standard error estimates, Taylor linearization was employed. In addition, the weightings provided by NLTS2 were used to adjust for nonresponse rates.

The preliminary analyses remained the same for all three dependent variables (any additional disability, ADD/ADHD, and LD). Sensitivity studies of outliers indicated no substantive inferential differences. Although assessments of correct fit are computationally unavailable for clustered logistic regression (Archer, Lemeshow, & Hosmer, 2007), running the Hosmer-Lemeshow tests as if the data were unclustered yielded nonsignificant results for all three analyses, which may indicate correct fit.

Predicting the presence of any additional disabilities. This analysis addressed the first research question by attempting to predict the presence of additional disabilities with accommodation access. Overall, this yielded null results; the overall Wald test was nonsignificant, $X^2(10) = 11.31$, ($p > .10$). Additionally, none of the predictors were statistically significant (Highest $X^2[10] = 2.77$, $p > .05$). A post hoc power analysis indicated that the regression achieved 80% power to detect an odds ratio of 1.6, and it achieved 95% power to detect an odds ratio of 1.85. An odds ratio of 2.00 is generally considered to the cut-off for a predictor variable to be reliably able to distinguish between categories of the dependent variable (Ferguson, 2009). Thus, this analysis had sufficient power to detect any meaningful effect if one existed. This power analysis was conservative, because it assumed that the data were not stratified. More information about the individual odds ratios can be found in Table 4.

Predicting the presence of ADD/ADHD. This analysis addressed the second research question by predicting the presence of ADD/ADHD. The overall Wald test was significant, $X^2(10) = 27.29$, ($p < .001$), so the null hypothesis that accommodation access does not predict the presence of ADD/ADHD was rejected. Unless otherwise stated, the odds ratios reported here assume that all other predictors remained constant. In total, three predictors significantly predicted the presence of ADD/ADHD. Firstly, the odds of having ADD/ADHD were 0.274 times less likely for individuals who used technology ($X^2[10] = 13.65$, $p < .05$). Also, the odds of having these disorders were 5.59 times greater for individuals who had additional time for tests or assignments ($X^2[10] = 4.50$, $p < .05$). Finally, the odds of having ADD/ADHD were 0.249 times the baseline for individuals who used readers for tests, holding other predictors constant ($X^2[10] = 10.63$, $p < .01$). As with the first analysis, information about individual odds ratios can be found in Table 5.

Predicting the presence of learning disabilities. This final analysis addresses the second research question by attempting to predict the presence of learning disabilities; the overall Wald test was again significant

Table 4 Predicting the presence of any additional disabilities

Variable	Odds ratio estimate	Odds ratio (95% confidence interval)	Wald chi square	*p* value
Technology use	1.29	0.504 (3.31)	0.285	.59
Use of tutors	1.02	0.383 (2.73)	0.0021	.96
One-on-one support	1.29	0.474 (3.51)	0.248	.62
Interpreter access	1.68[a]	0.650 (4.32)	1.14	.29
Readers for tests	1.19	0.464 (3.07)	0.133	.71
Different forms of tests	2.06	0.880 (4.83)	2.77	.096
Extra time for tests	1.79	0.653 (4.90)	1.28	.26

[a]Odds ratio inverted to yield point estimates that were greater than 1; in this case, the presence of the accommodation predicted the absence of any additional disability.

Table 5 Predicting the presence of attention deficit disorder/attention deficit hyperactivity disorder

Variable	Odds ratio estimate	Odds ratio (95% confidence interval)	Wald chi square	*p* value
Technology use**	0.274	0.072 (1.04)	13.65	<.001
Use of tutors	1.97	0.485 (8.06)	3.62	.057
One-on-one support	0.398	0.066 (2.41)	0.90	.343
Interpreter access	0.187	0.068 (0.51)	1.00	.316
Readers for tests*	0.249	0.059 (1.05)	10.63	.001
Different forms of tests	3.07	1.09 (8.62)	3.57	.059
Extra time for tests*	5.59	1.60 (19.61)	4.50	.034

*$p < .05$; **$p < .01$.

$X^2(10)= 25.92$, ($p <.001$), so the null hypothesis that availability of accommodations does not predict the presence of learning disabilities was rejected. Two independent variables significantly predicted these disabilities; again, the odds ratios reported both assume that all other predictors remain constant. First, the odds of having an LD were 3.01 times greater for individuals who had readers for in-class or standardized tests ($X^2[10] = 5.09$, $p < .05$). This means that the odds of having an LD were 3.01 times higher for individuals who had readers as an accommodation. Also, the odds of having an LD were 0.141 times the baseline for individuals who had tutors ($X^2[10] = 14.96$, $p < .001$). Odds ratios for other independent variables are shown in Table 6.

Discussion and Implications

SDHH Accommodations

SDHH utilize several types of accommodations to access classroom instruction and to reduce barriers to demonstrating their grasp of educational material on exams. These accommodations may range from accommodations that are linked to SDHH's unique communication needs such as presentation of items in ASL to accommodations that are utilized by other students with disabilities such as extended time. The patterns of assessment accommodations use and effects of use on student test scores are summarized in the research literature (Table 2). This research literature includes findings that support the use of particular instructional accommodations (ASL, Ansell & Pagliaro, 2006; speech-to-text, Stinson et al., 2009) to ensure student access to class material and findings that indicate the inclusion of accommodations does not influence student retention or use of material (Marschark et al., 2009). The measured approach of this research also illuminates the role of various additional factors that influence accommodation patterns and effects for SDHH. The most salient of these factors appear to be age, written English proficiency, and accommodation quality (e.g., interpreter proficiency). The quality factor raises the issue of translation and back translation for test items. In the Johnson et al. (2001) study,

Table 6 Predicting the presence of learning disabilities

Variable	Odds ratio estimate	Odds ratio (95% confidence interval)	Wald chi square	*p* value
Technology use	0.342	0.099 (1.19)	2.83	.092
Use of tutors**	0.141	0.052 (0.38)	14.96	<.001
One-on-one support	2.23	0.778 (6.41)	2.23	.135
Interpreter access	1.00	0.268 (3.70)	0.00	.995
Readers for tests*	3.01	1.16 (7.87)	5.09	.024
Different forms of tests	0.969	0.332 (2.83)	0.00	.954
Extra time for tests	2.51	0.566 (11.11)	1.46	.226

*$p < .05$; **$p < .01$.

particular items were especially difficult to represent in ASL, and some item characteristics may have been "lost in translation."

These findings necessitate a closer look at literature outside of the literature reviewed in this article regarding translation of test items. Research regarding translation/back translation of items from English to ASL emphasizes that the translation process should not be taken lightly and incorporates a number of personnel to ensure that the translations produced are of sufficient quality and test administration may take longer (Brauer, 1993; Leigh & Anthony-Tolbert, 2001). Additionally, when an assessment is translated, there is the issue of creating or utilizing new norms rather than assuming that the norms for a previous assessment in English are directly comparable (Brauer, 1993). In addition to research on translation/back translation accommodations on accountability, standardized, and instructor-created tests, there is a wide research literature for guidelines regarding accommodations on specifically psychological assessments. Trends in this literature include some preferences among practitioners for using gestured or signed administrations of tests and utilizing measures that included norms for deaf and hard-of-hearing students (Braden, 1992). However, the complexity of changing standardized testing procedures raises questions regarding the validity of scores obtained from these assessments and reflects the difficulty of utilizing traditional standardized assessment methods with SDHH. In these situations, the assessor is left to ponder Phillips (1994) criteria: the purpose of the test, skills measured, and the inferences made about the student's abilities.

Complicating Factors: D/HH+

Beyond the necessity for more research into accommodations for SDHH, there is a special need for research into the effects of accommodations for SDHH+. Despite the growing number of SDHH with additional disabilities (Shaver et al., 2011), the research literature on SDHH and accommodations has yet to fully include these students and their unique characteristics. The accommodations research that does exist often does not include specific information regarding these students or, alternatively, restricts their sample based on reading level, which may not clearly include or exclude all of these students. The importance of English proficiency in accommodation research of SDHH may explain the use of this factor in excluding participants from these studies.

This study sought to include SDHH+ in the body of accommodation research literature. The result of the first analysis comparing accommodations use of SDHH and SDHH+ was not significant. In other words, this analysis indicated that it was not possible to predict whether a student had an additional disability based on his/her accommodation use. However, the specific analysis comparing specific disability categories to other SDHH and SDHH+ was significant for the two categories examined: SDHH with an LD (SDHH+LD) and SDHH with ADD/ADHD (SDHH+ADD/ADHD).

SDHH+LD were more likely to use readers for tests but were less likely to use tutors. It is not surprising that students with learning disabilities, particularly those with dyslexia or other disabilities in reading, would utilize readers during testing. However, utilizing this accommodation on tests that examine reading skills

is of tenuous validity, and the validity of this accommodation is better supported on tests that assess other content areas, such as math (Sireci, Scarpeti, & Li, 2005). However, it is surprising that these students, who may take longer to read written material, would be less likely to use tutors. It is possible that the provision of a reader for tests helps ameliorate some of the difficulties students have with printed text and thus additional time is not necessary for these students in this context.

SDHH+ADD/ADHD were more likely to use additional time and less likely to use technology and readers for tests. It is not surprising that students who have ADD/ADHD are less likely to use readers in comparison with other SDHH+, such as students with learning disabilities. These students have difficulty with distractibility and sustained attention, rather than skills specific to content areas (e.g., math). Similarly, these students' co-occurring disability is not directly addressed by technology use and thus they are less likely to use technology in comparison with other SDHH+.

It appears that students' disability characteristics play a role in the accommodations that they use. These results indicate that clumping SDHH and SDHH+ together is not sensitive to the differences among SDHH+, namely the specific disability (or disabilities) that places them in the SDHH+ category. When one does not disaggregate results by specific disability, even with in the SDHH+ categorization, one loses the meaningful variability that translates to differences in accommodation use.

Limitations

There are several limitations to the analysis in this article. The first is a very trying dilemma experienced by researchers seeking to study accommodations use within a particular disability group. When the student's disability is utilized as a grouping variable, it is acting as a proxy for a group of characteristics assumed to be homogeneous among that group of students by virtue of sharing the particular label. Realistically, this is not an assumption that can be assured when examining the accommodation use of deaf and hard-of-hearing students. However, in this case we sought to add a layer to traditional analysis, which examines SDHH on the basis of that label alone, by examining students' additional disabilities. The results of the analysis bear out the importance of incorporating variables that further specifies the characteristics of student groups (e.g., SDHH+LD; SDHH+ADHD) when doing group-level analysis.

Of great importance to the accommodations discussion is the limitation that the chosen variable in the NLTS2 data set groups deaf and hard-of-hearing students into a single group. This means that individual student differences in degree of hearing loss are not directly addressed in this article, glossing over any differences in how these characteristics may affect their accommodations use. Additionally, grouping deaf and hard-of-hearing students in the same category for analysis regarding additional disabilities assumes that prevalence of additional disabilities is similar for these two groups. Similarly, this analysis did not include students who were deafblind in the analysis as SDHH+ due to the cultural aspects specific to this group of individuals that differentiate them from SDHH. These limitations may restrict applications of this research to work with students who are SDHH+, and analyses along these lines are potential avenues for future research with this growing group of students.

Despite a large sample size with respect to research regarding SDHH, there were not enough students with particular disabilities to enable analysis for particular disabilities such as mental health diagnoses, traumatic brain injury, or physical/motor disabilities. Therefore, there may be other accommodations differences for these groups that the researchers were unable to find due to sample size limitations. This reiterates the difficulty in running large-scale quantitative statistics procedures with a low-incidence population. It is unlikely that a larger sample of SDHH+ could be gathered, making large-scale accommodations package use analysis for other disability categories difficult.

Implications

The relationship between a student's disability and their use of accommodations is complex and can depend on the students' context. For example, a student with a lower level of hearing loss may require particular accommodations only in situations where many individuals are speaking but not require these same accommodations in a one-on-one interaction. Additionally, accommodations packages are not necessarily static, and

the students' context may dictate what accommodations they require and provision of an accommodation the student does not need or that is unhelpful may influence the expression of their additional disability. If a student who typically has access to an interpreter in one setting but does not in another setting, expression of the students' additional disability, such as an LD, may become amplified. The student may appear to understand less of the material covered in class because they did not have full access to the material. Conversely, if a student was not previously identified as having an LD, not having access to this interpreter may mean the student appears to have an LD because they are not retaining the material commensurate with their peers. This concept underscores the importance of reevaluation of a student's accommodation needs and the specificity of accommodations to the student. It also emphasizes the need to have personnel who are experienced in assessments of individuals who are D/HH and have additional disabilities (Morgan & McCay, 1994).

The results of this analysis also highlight the need for professionals to consider all of the student's abilities and disabilities when evaluating the specific accommodations recommended for students. If a professional focuses only on the student's hearing loss or whether the student has an additional disability, they miss the integrated picture of the student's accommodation needs. The professional must examine the student's particular additional disability and bring that into the accommodations discussion, even if the hearing loss is considered the primary disability category. The intersection between the student's disability categories holds the key to making accurate and informed decisions about the proper accommodations for the student.

Conclusion

Examining the accommodations use of SDHH+ represents a new and exciting area of research. These students have not fully been included in the accommodations literature or the even the smaller pool of accommodations literature that focuses on SDHH. Thus, this article offers valuable insight into the accommodations that SDHH+ use. Additionally, this article indicates that the accommodations use for these students is different from SDHH without additional disabilities in an unexpected way. In other words, the type of additional disability is more important than the fact that they have an additional disability in determining the accommodations that SDHH use.No conflicts of interest were reported.

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